Proper screen drying and prevention of contamination

A technical information article
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Screens and the stencils they support are the most critical part of the screen printing process. Screen preparation is a multitude of procedures in the screen printing process. Screen preparation contains the majority of variables and problems that can occur in screen printing. It is easiest to control the variables and problems in screen preparation when screens are processed in properly designed and controlled environments.

The use of enclosures and cabinets for proper screen drying and storage along with the prevention of contamination an important part of an optimum controlled environment.

This article will focus on the importance of contamination free drying after cleaning and after coating. This article will also cover theory and design involved and building drying cabinets and proper screen storage.

Before applying capillary film or coating a screen with liquid emulsion, the mesh must be dry free of contaminants. New mesh and new screens can be contaminated from storage, shipping and handling, and will need to be cleaned before use.

Cleaning steps include:

1. All ink is removed from the screen and frame.
2. Emulsion remover applied and emulsion removed with a pressure sprayer.
3. Screens should be scrubbed lightly with a clean brush and a suitable degreaser.
4. Degreaser foam rinsed with a low pressure flush of clean water.
5. Screen frame and mesh must be dried completely before coating.

Starting at cleaning step 4., inadvertent contamination problems begin. Quick removal of as much moisture as possible from the mesh is imperative. There is a shop vacuum head available, designed specifically for screen mesh cleaning.

Additional contamination can occur while drying. Fan usage will blow dirt and lint directly on the screens. The best method for drying is one that filters the air, raises the temperature, and removes moisture saturated air.

A complete seal on a cabinet will prevent contamination. Unfortunately this will also concentrate the air in a small area leading to moisture saturation. Once air is saturated with moisture it can no longer carry moisture away from the frames. Heated air will carry more moisture but too high of a temperature will cause accelerated premature exposure. Filtered air flow into and out of the drying room or cabinet will eliminate air saturation and aid in drying.

Coating and drying liquid emulsion:

1. Liquid emulsion is best applied in a light-safe room with high humidity. Higher humidity levels will help prevent the liquid emulsion from drying too quickly and from thickening in the trough, causing inconsistency.

2. Liquid emulsion from the container is 60%-70% water. Liquid emulsion must dry forming a solid area sealing the mesh. To prevent underexposure and to develop an acceptable sensitivity to light emulsion must be thoroughly dried. Most manufactures recommend a moisture content below 30%.

3. Emulsion manufacturers recommend drying liquid emulsion in air that is heated to 90-105 deg. F. with a relative humidity of 50% or less. To reach this level you often have to drag filtered air from an air conditioned room or install a dehumidifier into your cabinet or storage room.

A quick note on storage of dried screens. Once dried, coated screens are best stored in a cool, dry, dark area. This will extend their shelf life. Unexposed emulsion will reabsorb moisture from the air. Storage in high humidity will require that the screens be dried again before exposure.

There are many storage and drying cabinets available on the market. Or, if you feel up to the task, you can construct a cabinet that is functional and will speed up the drying process. Many user-constructed drying cabinets are far superior to drying cabinets available on the market.

Drying cabinet interior concepts:

1. Air temperatures ranging from 80 to 90 deg. F. with a humidity level of less than 50% are optimum. Temperatures above 90 deg. F increase the possibility of bubbles forming in the drying emulsion resulting in pinholes. Temperatures above 105 deg. F negatively affect emulsion exposure and recent studies indicate higher drying temperatures cause loss in mesh tension.

2. Dry filtered air circulating across the surface of each coated screen.

3. A separate chamber for the heater and or the dehumidifier creates a baffle preventing direct heated air from concentrating on the closest screens. Sufficient air movement speed is needed to prevent hot spots and dead air locations.

4. Air movement not to exceed one complete exchange every 2-5 minutes. The CFM (Cubic Feet per Minute) rating of each fan is printed on the box. Calculating the cubic area of the inside of the box is computed as depth times width times length (D x W x L).

5. Screens should be stacked so that air can circulate on all sides. Air inlets and outlet vents should be placed so that good air movement will occur in every corner of the cabinet.

6. Cabinets with removable racks on wheels can be used for storage and movement in and out of the cabinet.

There are two types of drying systems, the closed systems are independent of outside conditions and open systems draw air from outside.

A closed system requires both a heater and a dehumidifier (Fig. 1). A closed system is completely sealed and independent of all outside air conditions.

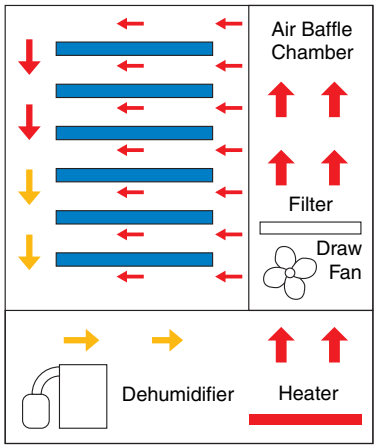


Fig. 1

An open system requires a heater only and draws air from outside (Fig. 2). An open system requires air from an air conditioned room or other low humidity environment.

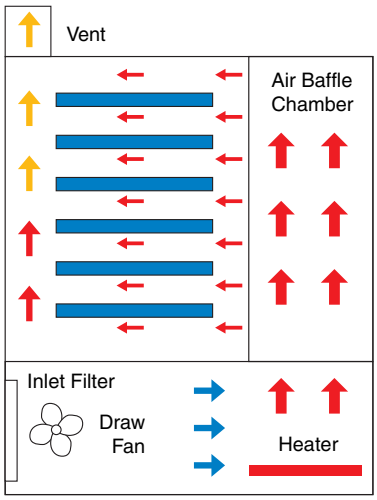


Fig. 2

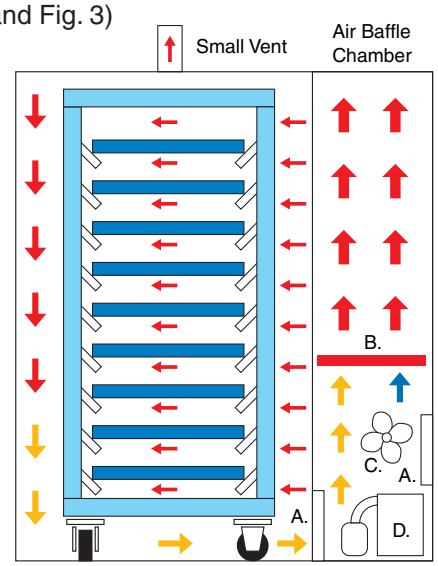
Drying cabinet systems and air pressure concepts:

1. Positive pressure can be created by having a smaller exhaust vent opening than intake opening. Positive pressure prevents contamination from entering the cabinet past the door seals. In addition, positive pressure allows for air expulsion when the door is opened.

2. Air can be circulated within a sealed cabinet. This would require a dehumidifier and a heater to create a low humidity environment.

3. Air can be introduced from the outside, requiring a heater and a filter. Air from an air conditioned room provides lower humidity, but will require the venting from the cabinet to be directed outside of the room. (Fig. 2)

4. The most desirable cabinet design would be a combination of dehumidifier, heater, and filtered outside air with an adjustable intake and exhaust vents providing positive pressure. (Photo 1, 3 and Fig. 3)



Filters A., Heater B., Draw Fan C., Dehumidifier D.

Fig. 3

Drying cabinet construction:

Most materials needed for cabinet construction can be obtained from the local building supply.

The cabinet frames can be constructed with 2 x 4 or 2 x 2 lumber, and covered with particle board or OSB products. The cavities created between the studs in the frame are ideal for use as air ducting.

Bare untreated wood products are damaged by exposure to moisture therefore components should be painted with a quality exterior paint before assembly. All joints should be glued and (or) caulked.

Composite board products can be mounted to the cabinet by piano hinges, creating easy moving solid doors. Doors can incorporate standard weather stripping products to create a positive seal.

Durable spring loaded latches can be made from 1 x 2 strips mounted on lag bolts (Photo 1). Spring loaded latches press the door tight against the rubber seal.

Photo 1

Inexpensive bathroom ventilating fans are designed to mount easily between properly spaced studs, and are made to operate in humid areas (Photo 2).

Photo 2

Racks can be constructed with parallel PVC pipe used for rack shelves (Fig. 4). Pegs of PVC pipe or dowels set at an angle can provide support without touching the drying emulsion. (Photo 4)

Photo 1.

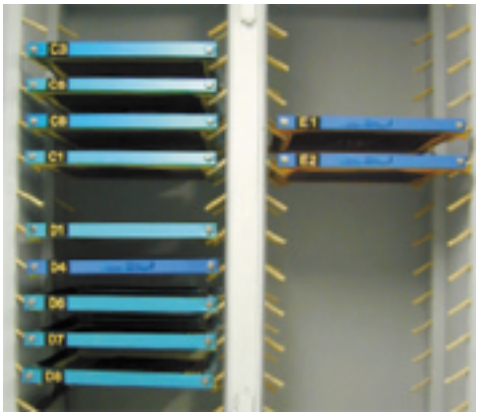


Photo 4

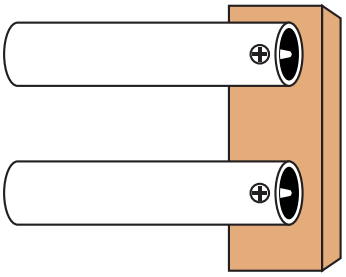


Fig. 4

A well made drying cabinet will increase shop efficiency, decrease drying time, and make the use of emulsion products and techniques easier.

Stay consistent and you will be able to predict your results with greater accuracy. Your goal should be consistency, predictability, and repeatability.

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A simple exploded drawing of an open system drying cabinet.

1. Exterior Panels

2. Door Panel

3. Rack frame

4. Rack Pins

5. Vent Hole

6. Inlet Hole

7. Baffle Wall With Circulation Holes

8. Baffle Supports